IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Inventor: David Stevenson Spain Jr.

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Docket No.: 465-009US

Title: Location Estimation of Wireless Terminals Through Pattern Matching of Deduced Signal Strengths

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

APPEAL BRIEF UNDER 37 CFR 41.67

Pursuant to 37 CFR 41.67, this brief is filed in support of the appeal in this application.

REAL PARTY IN INTEREST

The real party of interest in this application is the assignee of this application: Polaris Wireless, Inc., which is a Delaware corporation and which has its principal place of business in Santa Clara, California . The attorneys for this Appeal, DeMont & Breyer, LLC, have an equity interest in the assignee of this application.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1-28 stand rejected and are being appealed.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention relates to radio navigation in general, and, in particular, to a technique for determining the latitude and longitude of a "wireless terminal" (*e.g.*, a cell phone, a WiFi device, *etc.*). An understanding of the present invention and the prior art requires some context and a little familiarity with radio navigation, and, therefore, some background information is presented.

Figure 1 depicts a map of geographic region 120 which depicts a wireless telecommunications system that provides wireless telecommunications service to wireless terminal 101. (Applicants' Specification [0004] and Figure 1)

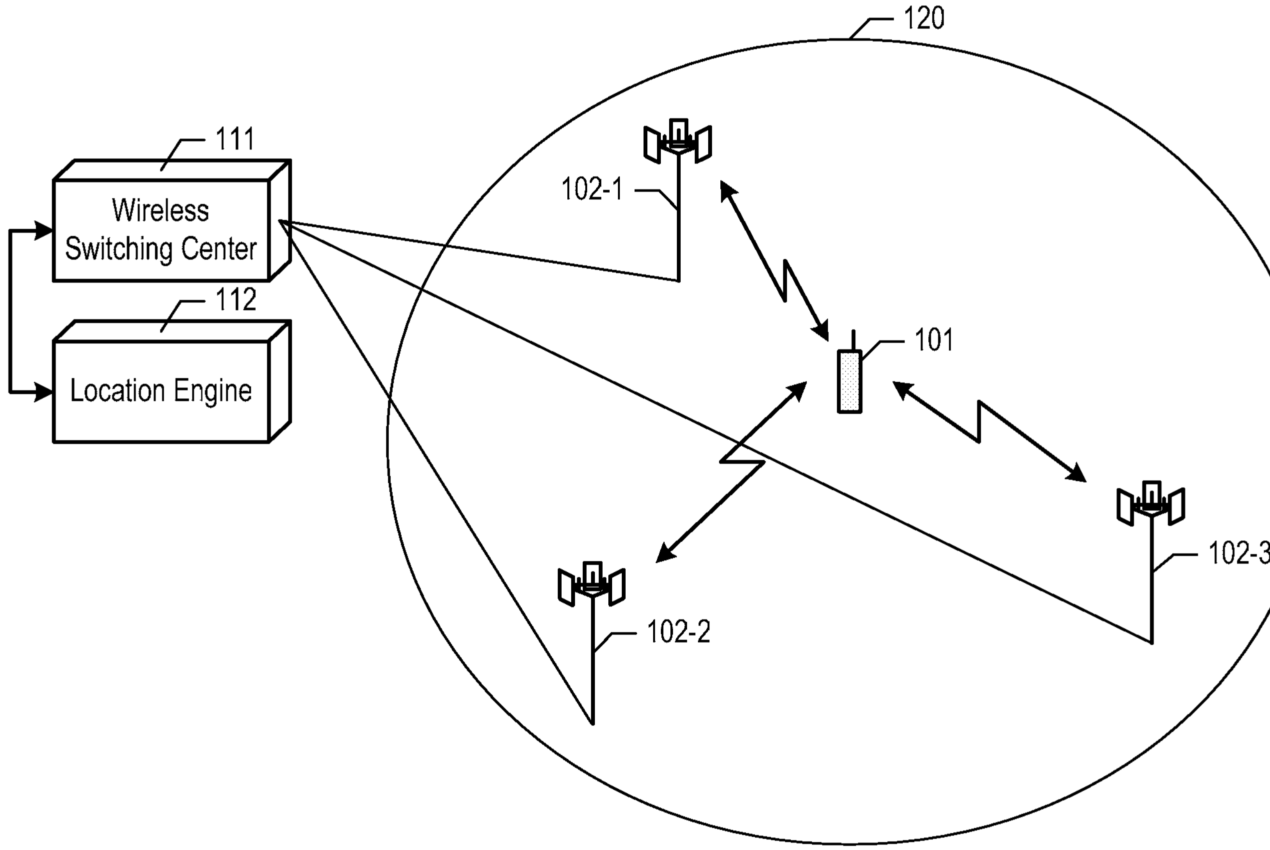

Figure 1 — Map of Region 120

The present invention is intended to be used with both the familiar cellular telephone and also with non-cellular terminals (*e.g.*, WiFi and Bluetooth devices, SMR terminals, *etc.*) and that is why the terms "wireless terminal" and "wireless telecommunications system" are

used in this application instead of the more familiar terms "cellular phone" and "cell phone system."

The heart of the telecommunications system is wireless switching center 111. Wireless switching center 111 is connected to a plurality of base stations (*e.g.*, base stations 102-1, 102-2, and 102-3), which are dispersed throughout geographic region 120. (Applicants' Specification [0004] and [0005])

As is well known to those skilled in the art, wireless switching center 111 is responsible for, among other things, establishing and maintaining calls between wireless terminals and between a wireless terminal and a wireline terminal (which is connected to the system via the local and/or long-distance telephone networks and which are not shown in Figure 1). (Applicants' Specification [0006])

The salient advantage of wireless over wireline telecommunications lies is in the mobility that is afforded to the user of the wireless terminal. On the other hand, the salient disadvantage of wireless telecommunications lies in that fact that because the user is mobile, an interested party might not be able to readily ascertain where the user is. (Applicants' Specification [0007])

Such interested parties might include both the user of the wireless terminal and remote parties. There are a variety of reasons why the user of a wireless terminal might be interested in knowing his or her own location. For example, the user might be interested in telling a remote party where he or she is, or in getting directions from where he or she is to another location. (Applicants' Specification [0008])

There are a variety of reasons why a remote party might be interested in knowing the location of the user. For example, the recipient of a 911 emergency call from a wireless terminal might be interested in knowing the location of the wireless terminal so that emergency services vehicles can be dispatched to that location. (Applicants' Specification [0009])

There are three classes of techniques for estimating the location of a wireless terminal:

i. Triangulation,
ii. Trilateralization, and
iii. Pattern-Matching.

The present invention uses pattern matching, and the relevant prior art uses a combination of all three techniques. Each of these will be discussed in turn.

<u>Triangulation</u> — In accordance with triangulation, the location of the wireless terminal is estimated based on the **<u>direction</u>** of the wireless terminal from three or more base stations whose latitude and longitude are known. This is depicted in Figure 2.

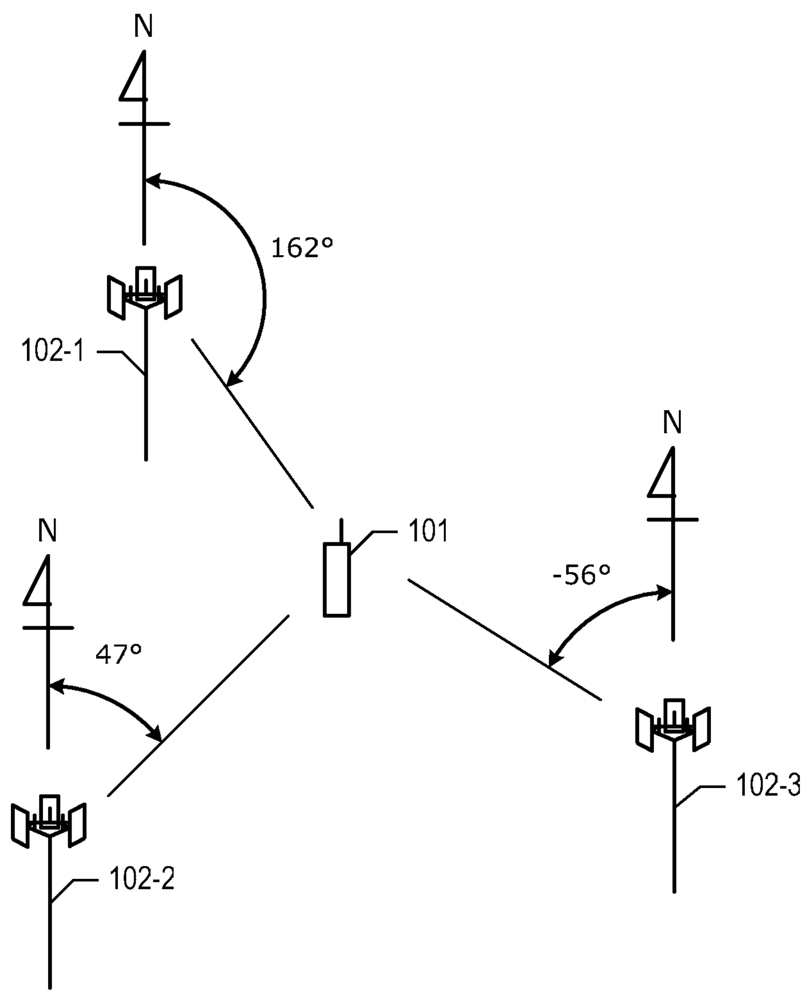

Figure 2 – Location of Wireless Terminal Based on Triangulation

To perform triangulation, the direction from each base station to the wireless terminal must be determined. How is this done? Typically, the directions are determined by directional antennas at the base stations.

There are many flavors of triangulation but, in general, it is not accurate enough for applications that require high accuracy (*e.g.*, 911 calls, *etc.*). Furthermore, triangulation is very expensive because it requires that directional antennas be placed at the base stations. (Applicants' Specification [0011])

Trilateralization — In accordance with trilateralization, the location of the wireless terminal is estimated based on the **distance** between the wireless terminal and three or more the base stations whose latitude and longitude are known. This is depicted in Figure 3.

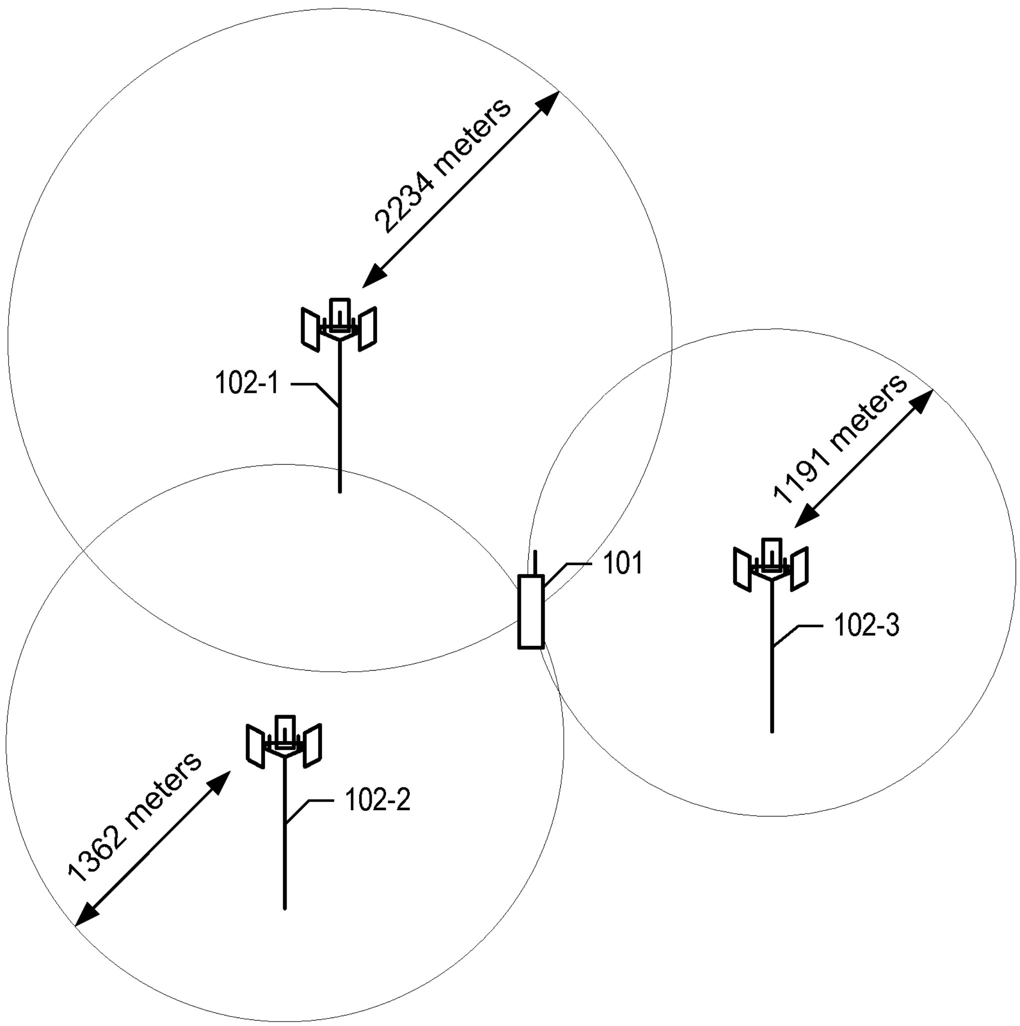

Figure 3 – Location of Wireless Terminal Based on Trilateralization

Trilateralization is similar to triangulation in the sense that both are based on vectors between the base station and the wireless terminal, but triangulation is based on the direction portion of the vector whereas trilateralization is based on the magnitude portion of the vector.

To perform trilateralization, the distance between each base station and the wireless terminal must be determined. How is this done? There are two ways: one is based on the

time it takes a signal to traverse the path between the base station and the wireless terminal, and the second is based on how much signal attenuation there is in the path between the base station and the wireless terminal. (Applicants' Specification [0011])

Trilateralization Based on Time - Trilateralization based on time is based on the fact that the amount of time it takes a radio signal to propagate from the transmitter to the receiver is a function of distance. In other words, if you know how long it takes a radio signal to propagate from the transmitter to the receiver, and you know the speed of propagation, you can easily calculate the distance between the transmitter and the receiver.

In free space, where there is an obstacle-free line-of-sight between the transmitter and the receiver, this technique is very accurate. How is the propagation time determined? In the case of modern cellular systems, the propagation time can be determined from:

(1) the time that it takes a signal to travel from the base station to the cell phone (which is known as the "forward" or "downlink" signal as shown in Figure 4), or
(2) the time that it takes a signal to travel from the cell phone to the base station (which is known as the "reverse" or "uplink" signal), or
(3) both the forward link and the reverse link (*i.e.*, one-half of the combined round-trip time).

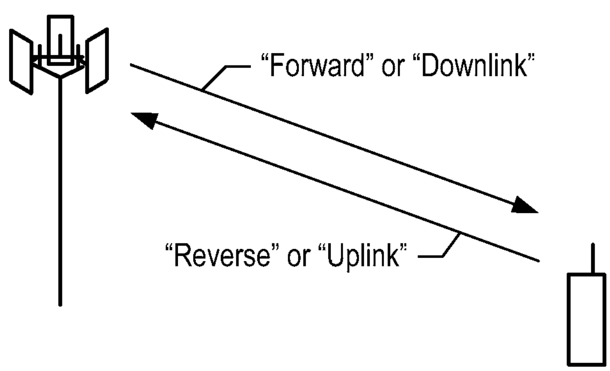

Figure 4 – Forward and Reverse Signals

But when — as in the case of modern cellular systems — there are radio frequency obstacles that reflect, refract, and absorb the signal and prevent an obstacle-free line-of-sight between the transmitter and the receiver, this technique is not accurate enough for many applications.

It should be noted that GPS uses trilateralization based on time and GPS requires an obstacle-free line-of-sight between the GPS receiver and the GPS satellites in orbit. When

it works, GPS is accurate to within meters and is advantageous in that it does not require that additional hardware be added to the telecommunication system's base stations or wireless switching center. GPS is disadvantageous, however, in that it does not work indoors or in dense urban areas (because the signals are blocked and reflected and refracted by buildings) and it cannot be used with legacy wireless terminals that do not comprise a GPS receiver. (Applicants' Specification [0013])

Trilateralization Based on Signal Attenuation — Trilateralization based on signal attenuation is based on the fact that the strength of a radio wave decays as a function of the square of the distance from the transmitter. Such a relationship is depicted in Figure 5. (Applicants' Specification Figure 7a)

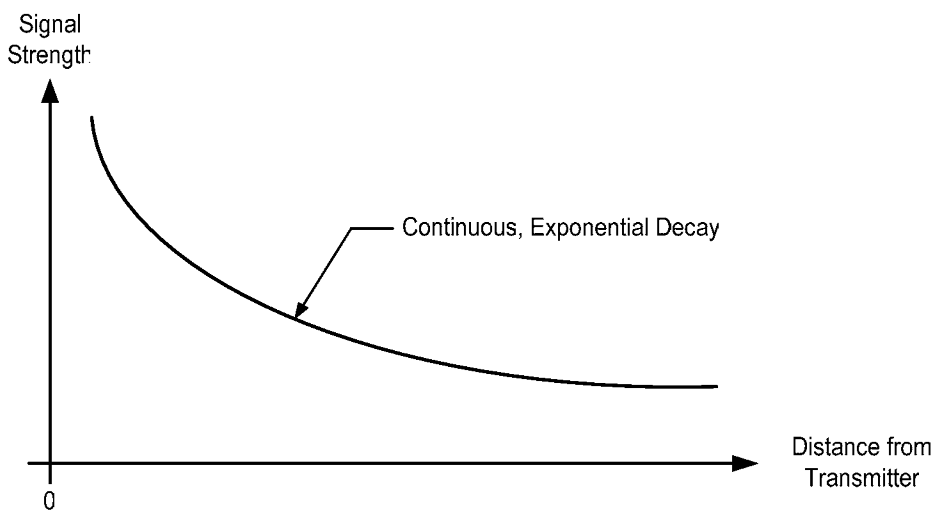

Figure 5 – Signal Strength Decay in Free-Space Environment Without RF Obstacles (Correlation Between Attenuation and Distance Exists)

If you know the strength of the signal at the transmitter and the strength of the signal at the receiver, the difference is the attenuation and from that you can easily calculate the distance between the transmitter and the receiver.

In free space, where there is an obstacle-free line-of-sight between the transmitter and the receiver, this technique is very accurate. How is the signal attenuation determined? In the case of modern cellular systems, the signal attenuation can be determined from:

(1) the attenuation in a forward or "downlink" signal, or

(2) the attenuation in a reverse or "uplink" signal, or

(3) a function (*e.g.*, the average, *etc.*) of both the forward and the reverse signal.

But when — as in the case of modern cellular systems — there are radio frequency obstacles that reflect, refract, and absorb the signal and prevent an obstacle-free line-of-sight between the transmitter and the receiver, this technique is not accurate enough for many applications because the straightforward correlation between attenuation and distance is destroyed. This is shown in Figure 6. (Applicants' Specification Figure 7b)

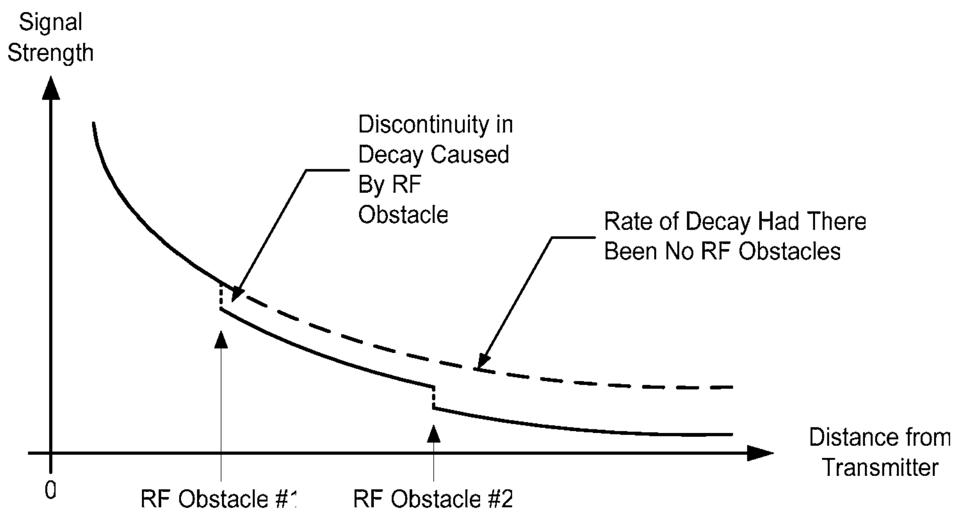

Figure 6 – Signal Strength Decay in Environment with RF Obstacles (Correlation Between Attenuation and Distance is Destroyed)

Pattern-Matching — The pattern matching class of techniques is based on the fact that as the wireless terminal moves from location to location, it:

(1) "sees" differences in the RF environment that are a causal and deterministic function of its location, and

(2) it causes changes in the RF environment at the base stations that are a causal and deterministic function of its location.

In other words, and with reference to Figure 7, as the wireless terminal moves from location to location:

(1) the wireless terminal can measure traits of the forward or "downlink" signals from the base stations that vary in a causal and deterministic function of its location, and

(2) the base stations can measure traits of the reverse or "uplink" signals that vary in a causal and deterministic function of the wireless terminal's location.

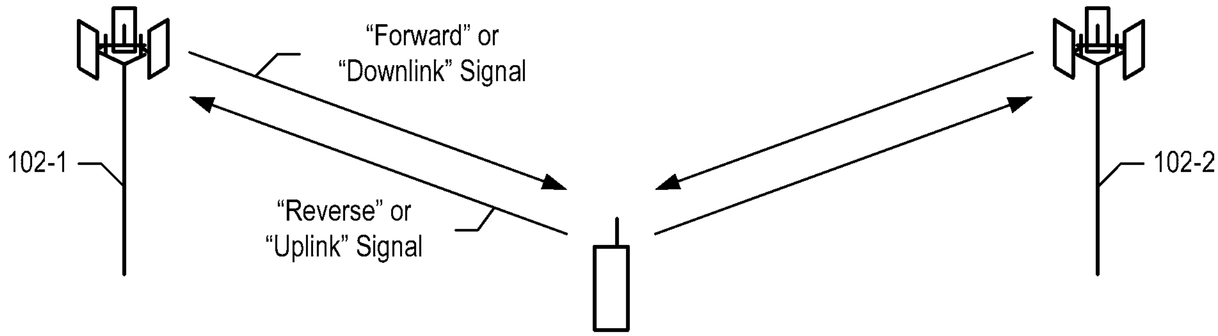

Figure 7 – Changes in Location of Wireless Terminal Affect Both What Wireless Terminal Sees of RF Environment in Its Vicinity and What Base Stations See in Their Vicinity

Given this fact, the location of the wireless terminal can be estimated by comparing traits of the RF environment when the wireless terminal is at an unknown location with traits of the RF environment when the wireless terminal is at one or more known locations. When the observed traits match the traits at a known location, you can reasonably surmise that the wireless terminal is at that location.

Using pattern matching to locate a wireless terminal is more or less analogous as a simple example will illustrate.

Suppose that a signal from Base Station A is known to be received at Location 1 with a strength of -65 dBm, at Location 2 with a strength of -98 dBm, at Location 3 with a strength of -77 dBm, and at Location 4 with a signal strength of -79 dBm, as depicted in Table 1.

	Strength of Signal from Base Station A	**Strength of Signal from Base Station B**
Location 1	-65 dBm	-92 dBm
Location 2	-98 dBm	-46 dBm
Location 3	-77 dBm	-55 dBm
Location 4	-79 dBm	-29 dBm

Table 1 – Illustrative Signal Strength Database

Suppose also that a signal from Base Station B is known to be received at Location 1 with a strength of -92 dBm, at Location 2 with a strength of -46 dBm, at Location 3 with a strength of -55 dBm, and at Location 4 with a signal strength of -29 dBm, as depicted in Table 1.

When a wireless terminal at one of these locations receives the signal from Base Station A with a strength of -67 dBm, the pattern matching technique can reasonably estimate that the wireless terminal is most likely at Location 1.

Note that pattern matching is fundamentally different from either triangulation or trilateralization in that no assumption is made regarding line-of-sight propagation or the presence or absence of RF obstacles and there is no attempt to estimate the distance to or direction of the transmitter.

All that is required for pattern matching is that:

(1) there is knowledge of the signal strength at each location,

(2) the wireless terminal is able to accurately measure signal strength, and

(3) *there is a significant difference in the signal strength at the each location*.

This last requirement is the one of interest to the present invention and warrants further discussion.

If the signal strength of the signal is not significantly different at two or more locations, then the likelihood that the wireless terminal is at each of those locations is a tie. For example, if a wireless terminal at one of the above four locations receives the signal from Base Station A with a strength of -78 dBm, the likelihood that it is at Location 3 or Location 4 is a tie. And how do we break a tie? By considering an additional signal whose signal strength is significantly different at the locations where the first signal is not significantly different. Therefore, if a wireless terminal at one of the above four locations receives the signal from Base Station A with a strength of -78 dBm and the signal from Base Station B with a strength of -31 dBm, the pattern matching technique can reasonably estimate that the wireless terminal is most likely at Location 4. The fact that the signal from Base Station B is used improves the accuracy of the estimate from the other signals, and, in fact, the more signals that are considered, the better.

So, now that we know that we need signal strength measurements — and as many of them as possible — where can we get them? In accordance with most cellular telephone systems, the cell phone itself measures the strength of six signals. If we could get more, that would be great, but it is not possible to get legacy wireless terminals to measure more than six signals.

But — and here is the invention — the value of a signal-strength measurement for one more signal — a 7th signal — can be *logically deduced* from other information available to the wireless system even though it is not actually measured.

But what signal can we "pretend" to measure that is doesn't already measure? — For reasons that are beyond the scope of the present discussion — a cell phone does not measure the signal strength of the signal coming from the base station that is providing cellular service to the cell phone. The six signal-strength measurements that the wireless terminal does make are for signals coming from the other base stations — base stations the wireless terminal might be handed off to. And since the wireless terminal cannot be handed off to its serving base station, it does not measure the signal strength of the signal coming from that base station.

From what information is the deduction made and how can the deduction be made? — The invention deduces the signal strength of the serving base station's signal at the wireless terminal, R_D, based on the principal of reciprocity. The principal of reciprocity states that the attenuation of a signal transmitted from Point A to Point B is the same as that for that signal as transmitted from Point B to Point A. (Applicants' Specification [0022])

In other words, the signal strength of the serving base station's signal at the wireless terminal, R_D, can be deduced from the strength at which the signal is transmitted by the base station, T_D, and the attenuation of that signal between the base station and the wireless terminal, A_D, by the function:

$$R_D = T_D - A_D \qquad \text{(Eq. 1)}$$

The principal of reciprocity indicates that the attenuation of the signal between the base station and the wireless terminal, A_D, equals the attenuation of that signal between the wireless terminal and the base station, A_U, as represented by Equation 2:

$$A_D = A_U \qquad \text{(Eq. 2)}$$

The attenuation of the signal between the wireless terminal and the base station, A_U, is equal to the strength at which the signal is transmitted by the wireless terminal, T_U, minus the signal strength of the signal as measured by the base station, R_U, as represented by Equation 3:

$$A_U = T_U - R_U \qquad \text{(Eq. 3)}$$

By substituting Equation 3 into Equation 2 and Equation 2 into Equation 1, the signal strength of the serving base station's signal at the wireless terminal, R_D, can be deduced

from the strength at which the signal is transmitted by the base station, T_D, the strength at which the signal is transmitted by the wireless terminal, T_U, and the signal strength of the signal as measured by the base station, R_U, as represented by Equation 4:

$$R_D = T_D - (T_U - R_U) \quad \text{(Eq. 4)}$$

And voila! The deduced value of R_D is equal to the 7th signal-strength measurement and can be used to estimate the location of the wireless terminal in exactly the same way as if it were directly measured. (Applicants' Specification [0027])

GROUNDS OF OBJECTION AND REJECTION TO BE REVIEWED ON APPEAL

Ground 1: 35 U.S.C. 102 Rejection of Claims 1-7, 10-16, and 19-26

Claims 1-7, 10-16, and 19-26 were rejected under 35 U.S.C. 102(b) as being anticipated by as being anticipated by D.J. Dupray, U.S. Patent 6,249,252 (hereinafter "Dupray"). The applicants respectfully traverse the rejection.

Ground 2: 35 U.S.C. 103 Rejection of Claims 8, 9, 17, 18, 27 and 28

Claims 8, 9, 17, 18, 27 and 28 were rejected under 35 U.S.C. 103(a) as being unpatentable over D.J. Dupray, U.S. Patent 6,249,252 (hereinafter "Dupray") in view K. Okanoue et al., U.S. Patent Application 2003/0064733 A1 (hereinafter "Okanoue"). The applicants respectfully traverse the rejection.

ARGUMENTS

Ground 1: Rejection of Claim 15

35 U.S.C. 102 Rejection of Claims 1-7, 10-16, and 19-26

Claims 1 through 7, 10 through 16, and 19 through 26 were rejected under 35 U.S.C. 102(b) as being anticipated by D.J. Dupray, U.S. Patent 6,249,252 (hereinafter "Dupray"). The applicants respectfully traverse the rejection.

Claim 1 recites:

> **1.** A method comprising:
>
> *deducing a signal strength of a first signal, R_D, at a wireless terminal based on a transmit strength of a second signal, T_U, that is transmitted by said wireless terminal*; and
>
> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

Nowhere does Dupray teach or suggest, alone or in combination with the other references, what claim 1 recites – namely deducing a signal strength of a first forward signal, R_D, at a wireless terminal based on a transmit strength of an reverse signal, T_U, that is transmitted by the wireless terminal. In other words, claim 1 recites using deductive logic to determine the signal strength of a forward signal, R_D, at a wireless terminal based on the strength of a signal transmitted by the wireless terminal, T_U. To reiterate, nowhere does Dupray teach or suggest *determining the signal strength of a forward signal at a wireless terminal based on the strength of an reverse signal transmitted by the wireless terminal*.

In general, Dupray teaches a technique for combining the triangulation, trilateralization, and pattern matching techniques to resolve conflicts and ambiguities in the individual techniques (Dupray Col. 3, lines 43-45).

In substantiating the rejection, the Office is employing the common "kitchen sink" attack wherein a long reference that uses some of the same words and phrases as are in the claims is deemed to anticipate the claims. This is, of course, sophistry at its worst.

The cited portions of Dupray are examined, line by line and sentence by sentence, to understand exactly what Dupray does and does not teach.

In general, the disputed portions of Dupray relate to the technique of using **trilateralization based on signal attenuation**. In particular, Dupray teaches that the attenuation can be determined from:

1. the signal strength of forward or "downlink" signals from the base station to the cell phone, or
2. the signal strength of reverse or "uplink" signals from the cell phone to the base station

and teaches the relative merits of using the forward and reverse signals. **Nowhere, however, does Dupray teach or suggest how deduce one of these measurements without actually making the measurement.**

I. First Cited Portion of Dupray

(column 25, line 63, through column 26, line 48)

Dupray recites:

> Note that in some embodiments of the present invention, ***both measurements of forward wireless signals*** to a target MS 140, ***and measurements of reverse wireless signals*** transmitted from the target MS to a base station ***can be utilized by various [models for estimating the location of the target MS]***.
>
> Dupray, column 25, line 63 through 67
>
> (***emphasis supplied***)

This sentence teaches that both measurements of the signal strength of the forward signals and the reverse signals can be used to estimate the location of a wireless terminal.

Dupray continues:

> In some embodiments of the present invention, the received relative signal strength ($RRSS_{BS}$) of detected nearby base station transmitter signals along the forward link to the target mobile station can be ***more readily*** used by the location estimate modules (FOMs) ***since the transmission power of the base stations 122 typically changes little during a communication with a mobile station.***
>
> Dupray, column 25, line 67 through column 26, line 12
>
> (***emphasis supplied***)

This sentence teaches that the measurements of the signal strength of the forward signals can be more readily used to estimate the location of the wireless terminal than the reverse signals because the transmission power of the forward signal changes little. In other words, Dupray is merely commenting that it is easier to use the forward signals than it is the reverse signals.

Dupray continues:

> However, the relative signal strength ($RRSS_{MS}$) of target mobile station transmissions received by the base stations on the reverse link may ***require more adjustment prior to location estimate model use***, since ***the mobile station transmitter power level changes nearly continuously***.
>
> Dupray, column 25, line 67 through column 26, line 12
>
> (***emphasis supplied***)

This sentence teaches that the measurements of the reverse signals might need to be adjusted prior to use in estimating the location of the wireless terminal because the transmission power of the reverse signal changes nearly continuously.

Why does Dupray teach that the measurements of the reverse signal need to be adjusted but that the measurements of the forward signal do not? Because his models for estimating the location of the wireless terminal assumes that changes in the strength of the signals is due to changes in path loss due to movement of the mobile station and not to changes in the transmitter power. The transmit power of the forward link does not change, and, therefore, no adjustment is needed to the forward link measurements. In contrast, the transmit power of the reverse signal does change, and, therefore, an adjustment is needed to the reverse signal measurement to compensate for the change in transmit power.

In other words, the measurement of a signal can change because of two factors: (1) a change in transmit power, and (2) a change in path loss due to the movement of the mobile station. The model for estimating the location of the wireless terminal assumes that changes in the signal measurements are due solely to changes in the path loss due to the movement of the mobile station and not to changes in transmit power.

Therefore, if there are changes in the transmit power, the affect of those changes must be negated. The forward transmit power does not change, and, therefore, no adjustment is necessary. The reverse transmit power does change, and, therefore, the measurements of the reverse signals are adjusted.

Dupray continues:

> In the CDMA air interface case, to perform such adjustments for wireless signal measurements of the reverse link, one adjustment variable and one factor value may be required by the signal processing subsystem 1220, i.e., (a) an instantaneous relative power level in dBm (IRPL) of the target mobile station transmitter, and (b) the mobile station 140 Power Class. ***By adding the IRPL to the $RRSS_{MS}$, a synthetic or derived relative signal strength ($SRSS_{MS}$) of the target mobile station 140 signal detected at the BSs 122 can be derived***, as shown below:
>
> $SRSS_{MS} = RRSS_{MS}$ + IRPL (in dBm)
>
> Dupray, column 26, line 12 through 21
>
> (***emphasis supplied***)

These sentences teach that the adjusted reverse signal strength equals the measured reverse signal strength plus the instantaneous transmit power of the wireless terminal. In other words, these sentences teach how to adjust the reverse signal power measurements so that changes in it are due solely to the movement of the wireless terminal and not to changes in transmit power.

Dupray continues:

> ***Accordingly, $SRSS_{MS}$ is a corrected indication of the effective path loss in the reverse direction (mobile station to BS), and therefore is now comparable with $RRSS_{BS}$ and can be used to provide a correlation with either distance or shadow fading because it now accounts for the change of the mobile station transmitter's power level.***
>
> Dupray, column 26, line 22 through 28
>
> (***emphasis supplied***)

This sentence teaches that the corrected reverse signal is (1) an indication of the path loss from the wireless terminal to the base station and thus to distance from the base station, and (2) is "comparable" to the uncorrected forward signal.

The first statement reinforces the fact that changes the signal strength must be due to path loss and not to changes in transmit power. The second statement also reinforces this idea by indicating that the reverse signal measurements are comparable with the forward signal measurements because all of the changes in both signals are now due to path loss and not to changes in transmit power. And because all of the changes in both signals are now due to path loss and not to changes in transmit power, the path loss can be used to determine distance for the purposes of trilateralization.

The Office has erroneously interpreted this sentence to mean that the adjusted reverse signal strength is equal to the unadjusted forward signal strength. Even if this were the correct interpretation of the sentence, it is incorrect as a matter of physics. The

adjusted reverse signal strength is **not** equal to the unadjusted forward signal strength. The value of one is completely independent of the other, and that is why Dupray fails to teach how to deduce one from the other.

There is, at most, only a superficial similarity between Dupray and the present invention. Yes, both use the same nomenclature, and yes both perform elementary arithmetic operations on signal strength measurements, but that is where the similarly ends. To suggest otherwise is sophistry.

Dupray continues:

> Note that the two signal measurements $RRSS_{BS}$ and ***SRSS***$_{MS}$ can now be processed in a variety of ways to achieve a more robust correlation with distance or shadow fading.
>
> It is well known that Rayleigh fading appears as a generally random noise generator in wireless signals. Thus, Rayleigh fading can substantially degrade the correlation of either $RRSS_{BS}$ or ***SRSS***$_{MS}$ measurements with distance. Several mathematical operations or signal processing functions, however, can be performed on the $RRSS_{BS}$ or ***SRSS***$_{MS}$ measurements to derive more robust relative signal strength values, thereby overcoming or substantially compensating for the adverse Rayleigh fading effects. Examples of such signal processing functions include averaging, taking the strongest value and weighting the strongest value with a greater coefficient than the weaker value, then averaging the results. This signal processing technique takes advantage of the fact that although a Rayleigh fade may often exist in either the forward or reverse path, it is much less probable that a Rayleigh fade exists simultaneously on both the reverse and forward link.
>
> Dupray, column 26, line 28 through 48
>
> (***emphasis supplied***)

These sentences teach that Rayleigh fading can affect both the forward link measurements and the reverse link measurements and can be compensated for, in well-known fashion. There is no text here which is relevant to the issue at hand.

II. Second Cited Portion of Dupray

(column 28, line 59, through line 66)

Dupray recites:

loc_sig_cluster	Provides access to the collection of location signature signal characteristics derived from communications between the target MS 140 and the base station(s) detected by this MS (discussed in detail hereinbelow); in particular, the location data accessed here is provided to the first order models by the signal processing subsystem 1220; i.e., access to the "loc sigs" (received at "timestamp"

	regarding the location of the target MS)

This teaches a field in a location hypothesis. Nowhere in this portion does Dupray teach that the value of the forward signal measurement can be deduced from the value of the reverse signal measurement.

III. Third Cited Portion of Dupray

(column 37, line 12 through line 30)

Dupray recites:

> Low Level Wireless Signal Processing Subsystem for Receiving and Conditioning Wireless Signal Measurements
>
> A first functional group of location engine 139 modules is for performing signal processing and filtering of MS location signal data received from a conventional wireless (e.g., CDMA) infrastructure, as discussed in the steps (23.1) and (23.2) above. This group is denoted the signal processing subsystem 1220 herein One embodiment of such a subsystem is described in the U.S. copending patent application titled, "Wireless Location Using A Plurality of Commercial Network Infrastructures," by F. W LeBlanc, Dupray and Karr filed Jan. 22, 1999 and having application Ser. No. 09/230,109. Note that this copending patent application is incorporated herein entirely by reference since it may contain essential material for the present invention. In particular, regarding the signal processing subsystem 20. However, various other portions of this copending patent application may also provide essential material for the present invention.

Dupray here describes the function of one of his modules. Nowhere in this portion does Dupray teach or suggest that the value of the forward signal measurement can be deduced from the value of the reverse signal measurement.

For this reason, the applicants respectfully submit that the rejection of claim 1 is traversed.

Because claims 2 through 7 depend on claim 1, the applicants respectfully submit that the rejection of them is also traversed.

Claim 10 recites:

> **10.** A method comprising:
>
> *deducing a signal strength of a first signal, R_D, at a wireless terminal based on a signal-strength measurement of a second signal, R_U, at the location where said first signal is transmitted*; and
>
> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

For the reasons given above with respect to claim 1, nowhere does Dupray teach or suggest, alone or in combination with the other references, what claim 10 recites – namely *deducing a signal strength of a forward signal, R_D, at a wireless terminal based on a signal-strength measurement of an reverse signal, R_U* at the location where the forward signal, R_D, is transmitted.

For this reason, the applicants respectfully submit that the rejection of claim 10 is traversed.

Because claims 11 through 16 and 19 depend on claim 11, the applicants respectfully submit that the rejection of them is also traversed.

Claim 20 recites:

> **20.** A method comprising:
>
> deducing a signal strength of a first signal, R_D, at a wireless terminal based on an attenuation of a second signal, A_U, that is transmitted by said wireless terminal; and
>
> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

For the reasons given above with respect to claim 1, nowhere does Dupray teach or suggest, alone or in combination with the other references, what claim 20 recites – namely deducing a signal strength of a forward signal, R_D, at a wireless terminal based on an attenuation of a second signal, A_U, that is transmitted by said wireless terminal.

For this reason, the applicants respectfully submit that the rejection of claim 10 is traversed.

Because claims 21 through 26 depend on claim 20, the applicants respectfully submit that the rejection of them is also traversed.

35 U.S.C. 103 Rejection of Claims 8, 9, 17, 18, 27 and 28

Claims 8, 9, 17, 18, 27 and 28 were rejected under 35 U.S.C. 103(a) as being unpatentable over D.J. Dupray, U.S. Patent 6,249,252 (hereinafter "Dupray") in view K. Okanoue et al., U.S. Patent Application 2003/0064733 A1 (hereinafter "Okanoue"). The applicants respectfully traverse the rejection.

Claim 1 recites:

> **1.** A method comprising:
>
> *deducing a signal strength of a first signal, R_D, at a wireless terminal based on a transmit strength of a second signal, T_U, that is transmitted by said wireless terminal*; and

> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

Because claims 8 and 9 depend on claim 1, and because Okanoue fails to cure the deficiencies of Dupray with respect to claim 1, the applicant respectfully submits that the rejection of claims 8 and 9 is traversed.

Claim 10 recites:

> **10.** A method comprising:
>
> *deducing a signal strength of a first signal, R_D, at a wireless terminal based on a signal-strength measurement of a second signal, R_U, at the location where said first signal is transmitted*; and
>
> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

Because claims 17 and 18 depend on claim 10, and because Okanoue fails to cure the deficiencies of Dupray with respect to claim 10, the applicant respectfully submits that the rejection of claims 17 and 18 is traversed.

Claim 20 recites:

> **20.** A method comprising:
>
> deducing a signal strength of a first signal, R_D, at a wireless terminal based on an attenuation of a second signal, A_U, that is transmitted by said wireless terminal; and
>
> estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.
>
> (*emphasis supplied*)

Because claims 27 and 28 depend on claim 20, and because Okanoue fails to cure the deficiencies of Dupray with respect to claim 20, the applicant respectfully submits that the rejection of claims 27 and 28 is traversed.

CONCLUSION

The applicants have demonstrated that the logic underlying the Office's rejection is untenable, and, therefore, that the rejection is not sustainable. For this reason, the applicants respectfully request the Board of Appeals to reverse the decision of the Examiner as provided for in 37 C.F.R. 41.50(a).

Respectfully,
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Claims Appendix

1. (original) A method comprising:

deducing a signal strength of a first signal, R_D, at a wireless terminal based on a transmit strength of a second signal, T_U, that is transmitted by said wireless terminal; and

estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.

2. (original) The method of claim 1 wherein deducing said signal strength of said first signal, R_D, is also based on a transmit strength of said first signal, T_D.

3. (original) The method of claim 1 wherein deducing said signal strength of said first signal, R_D, is also based on a signal-strength measurement for said second signal, R_U, at the location where said first signal is transmitted.

4. (original) The method of claim 1 wherein deducing said signal strength of said first signal, R_D, is also based on an attenuation for said second signal, A_U, between said wireless terminal and the location where said first signal is transmitted.

5. (original) The method of claim 1 wherein estimating the location of said wireless terminal comprises pattern matching said signal strength of said first signal, R_D, against a database that associates candidate locations for said wireless terminal with predicted signal-strength measurements for said first signal.

6. (original) The method of claim 1 wherein estimating the location of said wireless terminal is also based on a signal-strength measurement of a third signal, R_1, at said wireless terminal.

7. (original) The method of claim 6 wherein estimating the location of said wireless terminal is based on said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

8. (original) The method of claim 6 wherein estimating the location of said wireless terminal is based on the absolute magnitude of the difference between said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

9. (original) The method of claim 6 wherein estimating the location of said wireless terminal comprises generating a two-dimensional probability distribution for the location of said wireless terminal based on the absolute magnitude of the difference between said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

10. (original) A method comprising:

deducing a signal strength of a first signal, R_D, at a wireless terminal based on a signal-strength measurement of a second signal, R_U, at the location where said first signal is transmitted; and

estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.

11. (original) The method of claim 10 wherein deducing said signal strength of said first signal, R_D, is also based on a transmit strength of said first signal, T_D.

12. (original) The method of claim 10 wherein deducing said signal strength of said first signal, R_D, is also based on a transmit strength of said second signal, T_U, that is transmitted by said wireless terminal.

13. (original) The method of claim 10 wherein deducing said signal strength of said first signal, R_D, is also based on an attenuation for said second signal, A_U, between said wireless terminal and the location where said first signal is transmitted.

14. (original) The method of claim 10 wherein estimating the location of said wireless terminal comprises pattern matching said signal strength of said first signal, R_D, against a database that associates candidate locations for said wireless terminal with predicted signal-strength measurements for said first signal.

15. (original) The method of claim 10 wherein estimating the location of said wireless terminal is also based on a signal-strength measurement of a third signal, R_1, at said wireless terminal.

16. (original) The method of claim 15 wherein estimating the location of said wireless terminal is based on said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

17. (original) The method of claim 15 wherein estimating the location of said wireless terminal is based on the absolute magnitude of the difference between said signal

strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

18. (original) The method of claim 15 wherein estimating the location of said wireless terminal comprises generating a two-dimensional probability distribution for the location of said wireless terminal based on the absolute magnitude of the difference between said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

19. (original) The method of claim 10 further comprising removing the effects of fast fading on R_U.

20. (original) A method comprising:

deducing a signal strength of a first signal, R_D, at a wireless terminal based on an attenuation of a second signal, A_U, that is transmitted by said wireless terminal; and

estimating the location of said wireless terminal based on said signal strength of said first signal, R_D.

21. (original) The method of claim 20 wherein deducing said signal strength of said first signal, R_D, is also based on a transmit strength of said first signal, T_D.

22. (original) The method of claim 20 wherein deducing said signal strength of said first signal, R_D, is also based on a signal-strength measurement for said second signal, R_U, at the location where said first signal is transmitted.

23. (original) The method of claim 20 wherein deducing said signal strength of said first signal, R_D, is also based on a transmit strength of said second signal, T_U.

24. (original) The method of claim 20 wherein estimating the location of said wireless terminal comprises pattern matching said signal strength of said first signal, R_D, against a database that associates candidate locations for said wireless terminal with predicted signal-strength measurements for said first signal.

25. (original) The method of claim 20 wherein estimating the location of said wireless terminal is also based on a signal-strength measurement of a third signal, R_1, at said wireless terminal.

26. (original) The method of claim 25 wherein estimating the location of said wireless terminal is based on said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

27. (original) The method of claim 25 wherein estimating the location of said wireless terminal is based on the absolute magnitude of the difference between said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

28. (original) The method of claim 25 wherein estimating the location of said wireless terminal comprises generating a two-dimensional probability distribution for the location of said wireless terminal based on the absolute magnitude of the difference between said signal strength of said first signal, R_D, and said signal-strength measurement of said third signal, R_1.

Evidence Appendix

There is no evidence submitted pursuant to 37 CFR §§ 1.130, 1.131, or1.132.

Related Proceedings Appendix

There are no related proceedings.